

For a time the quantity of water thus obtained, as at Merton, Garrett, and many other points, seem to have induced the belief that an inexhaustible source of the all-essential element had been discovered; but the rapid multiplication of these Artesian wells soon revealed the fact that the new and valuable stores had their limit, and that this limit was being very rapidly approached in consequence of the excessive demands which were now being made upon the new source of supply. The deepening of the wells, by which means water was drawn from the Chalk, as well as from the Tertiary strata, promised, however, to do something towards staving off the evil day when London would no longer be able to depend on drafts being honoured by her great subterranean bank.

Such was the state of the question when Mr. Prestwich, now the Professor of Geology in the University of Oxford, undertook its complete investigation as an important geological problem. No one more competent for the task could possibly have been found, for during many years Mr. Prestwich's studies had been devoted to the Tertiary deposits of the London and Hampshire basins; and his great work—"A Geological Inquiry respecting the Water-bearing Strata of the country around London, with Reference especially to the Water-supply of the Metropolis," which was published in 1851—is a masterpiece of minute observation and close and accurate reasoning.

More than this, the geologist points to the work with pardonable pride, as affording convincing proof that his science has now acquired a character for exactness, analogous to that which is justly regarded as the crowning attribute of astronomy. After a most elaborate study of the nature and relations of the various strata which crop out all round the London Basin and of the disturbances to which they have been subjected since their deposition, Mr. Prestwich ventured on a bold *prediction*, namely, that the Chalk beneath London would be found to have a thickness of 650 feet, the Upper Greensand of 40 feet, and the Gault of 150 feet. (*Op. cit.* p. 142.)

At the time when this announcement was made no well in London had been sunk to a greater depth than 300 feet in the Chalk, but now we can appeal to no less than four deep borings in the metropolis, which afford the most convincing proof of the reliability of the data, and the accuracy of the reasoning by which Mr. Prestwich arrived at his interesting results. For the sake of distinctness, we place the estimated and determined results side by side in a tabular form:—

Mr. Prestwich's Estimate.	Boring at Kentish Town.	Boring at Crossness.	Boring at Loughton.	Boring at Meux's Brewery.
Chalk	650	645	646	650
Upper Greensand	40	13 $\frac{1}{2}$	12	40
Gault	150	130 $\frac{1}{2}$	148	(?)
				159

When it is remembered that the Chalk graduates downwards insensibly into the Upper Greensand, and that it is almost impossible to decide on their line of separation in the cores brought up by boring operations, it will be admitted on all hands that the agreement between the estimated and proved results is marvellously close.

One of the most important conclusions of Mr. Prestwich's work was that the strata below the Gault, the so-

called "Lower Greensand," would in the future afford a most valuable underground source of water-supply to our overgrown city.

But in 1855 Mr. Godwin-Austen brought before the Geological Society of London his masterly essay "On the Possible Extension of the Coal-Measures beneath the South-Eastern Part of England," in which he announced the conclusion—based on a most elaborate study of the geological structure of the South of England and the adjoining portions of the Continent of Europe—that an old ridge of Palæozoic rocks underlies the line of the Thames Valley, and is only concealed from us by the Upper Cretaceous strata.

Mr. Godwin-Austen's announcement was as strikingly verified as was that of Mr. Prestwich; for, in the same year that it was made, a boring at Kentish Town which passed through the Gault, reached a curious series of red rocks which are now believed by geologists to be either a portion of the old Palæozoic ridge itself, or a set of littoral deposits formed upon its flanks. And in 1857 the deep boring at Harwich afforded still more unmistakable evidence of the existence of this old Palæozoic ridge in the fact that black slaty rocks were found immediately below the Gault clay.

Although the old ridge of Palæozoic rocks must thus limit the area of the available water-bearing "Lower Greensand" beneath the metropolitan district, yet Prof. Prestwich has constantly argued that very large and valuable supplies of water will yet in all probability be obtained from the latter source.

Hence it is that the endeavour to tap this great subterranean reservoir, which is now being carried out in such an enterprising spirit by the Messrs. Meux and Co., in the Tottenham Court Road, is attracting so much attention from geologists and engineers. The nodular becls at the base of the Gault were reached at a depth of 999 feet from the surface, and some sixty feet of rock below has since been penetrated. The splendid cores brought up by the diamond-borer are at once submitted to Mr. Robert Etheridge, the palæontologist of the Geological Survey, who is carefully studying every trace of fossils which they exhibit. At present there are very strong grounds for believing that the "Lower Greensand" has been reached, and we soon hope to be able to announce that the new source of water supply, so long ago pointed out by Prof. Prestwich, has at last been made available for the ever-increasing necessities of this great city.

J. W. JUDD

LATHAM'S ENGLISH DICTIONARY

A Dictionary of the English Language. Abridged by the Editor from that of Dr. Samuel Johnson, as Edited by Robert Gordon Latham, M.A., M.D., &c. (London: Longmans and Co., 1876.)

WE consider ourselves justified in reviewing an English dictionary in these pages for two reasons; first, because the method of its construction ought to be rigidly scientific, and second, because a large proportion of the words in any modern English dictionary must necessarily be scientific terms.

It is admitted by all competent to pronounce an opinion that there is ample room for a new dictionary of the

English language ; that when Dr. Latham undertook the task for which his attainments so well fit him, he had an excellent opportunity for doing a splendid service to our tongue and making for himself a lasting name. The only dictionaries that make any pretence to exhaustiveness, Webster's, Worcester's, and the Imperial, with all their merits, come far short of what an ideal national dictionary should be, and they cannot for one moment be compared with Littré's *magnum opus*. Webster's etymology is extremely unsatisfactory and misleading in its method, the vocabulary is a conglomeration on no principle, and the definitions are too frequently unmethodical. We consider Worcester in some respects more satisfactory, more scientific in its method than Webster. The Imperial is rather a small encyclopædia than a dictionary, minute description frequently giving place to definition, and the vocabulary being much fuller than that of any existing dictionary. This feature, however, seems rather to be the result of a desire to crowd in as many words as possible than of any well-considered scientific plan. The etymology of the Imperial might almost have been written a century ago. Thus Dr. Latham had a splendid field before him, and Littré has shown what one man is capable of doing in the way of dictionary-making. We need not for the hundredth time contrast his work with the endless pottering of the French Academy. Perhaps it scarcely needs to be proved that in the construction of a dictionary, as in most other great undertakings, failure will surely be the result unless one competent man has the supreme command.

The work before us is an abridgment of Dr. Latham's larger work in four quarto volumes. The abridgment has been made mainly by the omission of the illustrative quotations which form so large a feature in the larger work, and of certain disquisitions on extremely minute points which occur during the progress of the work. Many will be of opinion that the omission of the latter is distinctly beneficial ; they are too frequently little else than laborious trifling. The omission of the quotations is, no doubt, a disadvantage ; they bear the same relation to and throw the same light on the definition that specimens do in the case of geology and experiments in other sciences. A very few have been retained, and it would have been an advantage had there been many more, as there might easily have been had the various meanings under each word been run on instead of being paragraphed.

Dr. Latham calls his dictionary a new edition of Johnson ; if it were only this it would be at once a confession that the work was an anachronism. To bring the heroic old compiler's work up to date would require quite as much labour as Johnson bestowed on the original ; and as Dr. Latham's work has so much that is new in all departments, we must regard its title as mainly an act of courtesy to the memory of "the great excigrapher." As the abridgment contains all the vocabulary of the larger work, the two in this respect may be regarded as identical, and from its size and price, the larger work is evidently meant to be a practically complete English dictionary.

Dr. Latham's vocabulary is of course much more extensive than that of Johnson. He has read largely in modern works in all departments of literature and

science, and thus been able to register many words that did not exist in Johnson's time, as well as many new meanings that have been given to old words. The consideration of vocabulary is probably the most serious that comes before any one who sets himself to the laborious task of compiling a dictionary. His duty is certainly to set down all words used by reputable writers. But is this all ? How far back is an English dictionary-maker to go ? to Spencer or to Chaucer ? Mr. Freeman might possibly say to "Beowulf." Who are to be considered "reputable" writers ? Should only "reputable" writers be taken into account ? And should no word that has not been printed in a regular way be admitted ? How far should slang terms and provincialisms, including Scotticisms (*pace* Prof. Blackie) be admitted ? Again, what is to be considered literature ? Must all science be excluded, and the vocabulary be confined to such words as occur in poetry, *belles lettres*, history, philosophy ? These and many other questions must be settled at the very outset by the compiler of a dictionary making any pretence to completeness, and we are glad to see that, to a considerable extent, Dr. Latham has settled them on the liberal side. His aim has apparently been to make a work that would be useful to people of wide culture and general reading, and he has interpreted the English language to be the language used by the people of England in expressing their thoughts on the varied subjects that engage their attention.

We are at a loss to discover the principle, however, on which Dr. Latham has compiled his vocabulary. He has certainly inserted a large selection of scientific terms, but the selection appears to us to have been made in a capricious and arbitrary manner. He has, for example, given many of the technical names of the divisions and subdivisions of the animal and vegetable kingdoms, but it is not easy to see by what clue he has been guided. Why should Raptore and Natatores find a place while Scansores, Insessores, and all the other avian orders are omitted ? Is it that the two former have been detected by Dr. Latham in some "literary" writer, while he has failed to come across the latter ? Even Amphibia and Amphibian find no place, nor the adjective Avian. We find Infusoria and Cetacea, and Monotremata, but no Rodentia nor Carnivora, nor a host of other names even more likely than those capriciously registered to be inquired for by readers of works of popular zoology. It is a very nice question whether this class of words should be admitted at all into an English dictionary, but if it be decided affirmatively the only satisfactory scientific method is to admit all. A generic name (*e.g.*, *Dionaea*) in this respect is quite as important as that of the largest subdivision in zoology or botany.

The defects of the dictionary are equally apparent in other scientific departments. We find Oolitic and Triassic and Drift, the last in some detail, but not Laurentian nor Cambrian, nor such a common word as Pothole. Biogenesis, Abiogenesis, Heterogenesis, and Bacteria are conspicuous by their absence ; as are also Eozoon, Atoll, Globigerina, Hippurion, and Amphioxus : Lepidostrewn is given in some detail. To Basin no geological meaning is assigned. Palæozoic (with a bare reference of Cænozoic and Mezoic) is found, but not Azoic ; Permian, but not Devonian, Silurian, or Purbeck ; Laby-

rinthodont but not Pycnodont. We have Protoplasma but neither Protoplasm nor Protoplasmic. Photosphere we find, but not Chromosphere, nor Corona in its solar application, and neither Heliostat nor Sidеростат. The dictionary contains various terms in electricity and magnetism, but not Magneto-Electric, Electro-Biology, Quantivalence, Anode, nor Cathode. Darwinian and Darwinism, long since used as current common terms, find no place here ; and no one would guess from the definitions of Evolution and Development the immense significance which these terms have assumed in recent times.

We could give many instances of similar caprice in the admission of scientific terms, but our space does not admit of it. But it is not alone in this class of terms that the vocabulary appears to us to be defective ; many words are wanting which, we venture to think, any man of common sense would look for in a modern English dictionary of the pretensions of that edited by Dr. Latham. Under Mule a reference is made to the spinning-jenny, but under neither Spinning nor Jenny is the use of the term explained. Readers of Arctic narratives will look in vain for an explanation of Ice-foot and Ice-master, and the reader will not be surprised at the omission of Snider, Whitworth, and Mitrailleuse. Can any sound reason be given for omitting such a word as Croquet ? And where are we to look for an explanation of such national terms as Over and Bye, if not in the most recent of English dictionaries, which registers the "cricketal" signification of Stump ? The work is evidently not meant for circulation in America, if we may judge from the absence of all Americanisms, even those which have become current coin in the English tongue, such as Bunkum, Caucus, Mocassin. Might not such words as Ecchymosis and Deopilation have been spared (who is likely to look for them ?) in favour of some or all of the terms referred to. Many words found in Tennyson, Morris, and Swinburne are marked as "obsolete," showing the danger of using the epithet at all.

The etymology seems to us unsatisfactory. To words whose origin is simple and obvious two or three lines are sometimes devoted ; while of others whose etymology is certain enough, but which it would have taken some time and trouble to trace, no satisfactory information is given. What satisfaction is it to be told simply that Abandon comes from French *abandonner*, especially when the history of the word can be so beautifully traced ? There is a like want of proportion in the definitions, which are in most cases extremely meagre, but in some cases capriciously and unnecessarily diffuse. In the arrangement of the various definitions under each word, moreover, we fail to discover, as a rule, any logical or historical method. In this as in some other respects Dr. Latham has stuck too closely to the old lines of dictionary construction, and missed the opportunity of compiling a work which might have cast all other similar works into the shade. We cannot say that it has de-throned either Webster or Worcester, unsatisfactory in many respects as these are ; and there are two or three smaller and cheaper dictionaries, which we venture to think would be more useful to the general reader. The field is still unoccupied, for Dr. Latham's work can never, in our opinion, serve as the standard dictionary of

our language. The work is handsome and well printed, and the "Historical Sketch of the English Language" is thoroughly satisfactory.

GUILLEMIN'S "WORLD OF COMETS"

The World of Comets. By Amédée Guillemin. Translated and Edited by James Glaisher, F.R.S. (London : Sampson Low and Co., 1877.)

M R. GLAISHER mentions that he was anxious that M. Guillemin's interesting work upon comets should appear in our language, from the fact of there not being so far any volume that occupied the ground covered by it, while, it may be added, that the recent important advances in this branch of the science renders a pretty complete summary of progress in late years a most desirable help and guide to the student, scattered as the reports of such progress almost necessarily are in the publications of scientific societies and in periodical scientific works at home and abroad.

The greater portion of the volume before us relates to those particular departments of the subject which may be expected to interest the general reader. The historical portion, especially in the earlier ages, when comets were regarded as omens, good or bad, to the time when Newton developed the laws by which their motions are governed, naturally commences the work ; then follow chapters upon their orbits, the periodical comets from the short revolution of Encke's comet, to the revolutions of several thousands of years which have been assigned with a greater or less degree of probability to other of these bodies ; more particular descriptions of several great comets in recent times, as the comets of 1744, 1811, 1843, 1858, 1861, and the great comet of Coggia in 1874, which made its appearance just prior to the publication of M. Guillemin's treatise. It is, however, in what we must term cometary physics that the volume is most complete, and in which its interest and probable usefulness will mainly consist. The theories of Olbers, Bessel, Faye, Roche, Tyndall, Tait, and others are noticed in a popular and readable style, and are fairly considered collectively, though differences of opinion must still prevail with regard to any inferences to be drawn from them. The researches of Dr. Huggins, Prof. Secchi, MM. Wolf and Rayet, in the spectral analysis of the light of comets, and particularly of Coggia's Comet of 1874, are described, and to these results, as collected by M. Guillemin, Mr. Glaisher has added an important article by Mr. Lockyer, which appeared while the great comet of 1874 was still visible, and in which are detailed the results of spectroscopic examination of the light of the comet with the aid of Mr. Newall's great refractor. The editor has also made some very desirable additions to M. Guillemin's chapter on "The Common Origin of Shooting Stars and Comets."

The work concludes with a list of elliptic comets and their elements and with a general catalogue of cometary orbits to 1876.

We have said that probably the chief interest and value of M. Guillemin's "World of Comets" will be found to consist in the extensive portion of his volume devoted to cometary physics, to the theories which have been advanced to explain their varied aspect, and the formation of the enormous trains by which some comets are accom-